



# ***Novel Chemical/Biological Protective Closure/Interface Systems***

## ***Overview:***

The Man-In-Simulant Test (MIST) system vapor test data showed high vapor penetration through activated carbon based permeable chemical protective garments around the closure and interface areas. In addressing this problem, the US Army Soldier and Biological Chemical Command (SBCCOM) and the US Navy Clothing & Textile Research Facility (NCTRF) have been jointly developing various closures and interfaces for CB protective clothing with industry and academic partners since 1997. This joint service (JS) project's objective has been to develop and test closure and interface concepts for integration of multi-piece CB protective garment ensembles. Two closure systems were developed: 1) Vapor, Aerosol, and Liquid (VAL) protective closure system that is impervious to liquid, vapor and aerosol CB agents suitable for use in membrane-based CB protective ensembles. 2) A vapor protective (V) closure system for minimizing aerosol, and vapor penetration suitable for activated carbon based permeable clothing systems, such as those developed under the Joint Service Lightweight Integrated Suit Technology (JSLIST) Program.



***Figure 1. Waterproof Closure***



***Figure 2. Water Resistant Closure***

## ***Status:***

Numerous V and VAL interface concepts have been explored by utilizing commercially available materials in combination with unique garment designs and fabric layering techniques. The most promising approaches have been down-selected and those deemed most promising produced into pre-prototype demonstration models. Through preliminary user evaluations, a V and a VAL protective closure systems were selected and prototypes produced and integrated onto prototype garments. These garments have been subjected to a variety of system tests as applicable. These includes thermal manikin test, human factor assessment tests, field durability tests, MIST system vapor tests, rain simulant test, and hydro-environmental (immersion) test. A cooperative research and development agreement (CRDA) was established allowing for industry cooperation and participation in the development of the VAL protective closure system and in various system tests.

## ***Military Significance:***

Effective CB protective closures and interfaces are vitally important for any CB protective garments, especially those made for the newly developed non-carbon-based selectively permeable materials, and also for the carbon-based air-permeable chemical protective garments such as the JSLIST overgarment. The use of such novel closures and interface developed from this JS CB Protective Closure/Interface Systems project would help to significantly reduce the agent vapor penetration and to improve the individual soldiers' survival and comfort in all types of environment in conducting their various missions.

## ***Point of Contact:***

**Quoc Truong** (Natick Soldier Center), DSN 256-5484, COMM (508) 233-5484,  
qtruong@natick-amed02.army.mil

**Cleveland Heath** (U.S. Navy Clothing & Textile Research Facility), COMM (508) 233-4785,  
cheath@natick-amed02.army.mil

U.S. Army  
Soldier and Biological  
Chemical Command

Soldier Systems Center  
Kansas Street  
Natick, Massachusetts  
01760  
www.sbcom.army.mil

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